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Experiments on the Growth of Cuttings from Wild American Vines.

[The subjoined report of Mr. W. G. Klee, gardener in charge of the experimental grounds at the University, on the results of experiments made on the relative facility of rooting and the root and stem growth of cuttings from wild American vines, was received too late for insertion into the annual report, lately published. It is here given in advance of the issuance of the viticultural appendix to the above report, as it will be of interest to those especially who are looking to the grafting of European grape varieties on resistant stocks as a safeguard against the phylloxera.

It will be timely to state, in this connection, that within the last few days (March 9th) that insect has been observed by Mr. F. W. Morse to be already actively engaged in the operation of egg-laying. This is being done, not by individuals hatched from any "winter egg," but simply by surviving adults of last season's late brood; while many semi-adults are rapidly developing toward maturity. It thus appears that the destruction of the winter egg, to which so much importance is attached in France, would with us serve only the purpose of restricting somewhat the farther infection from the outside, but would not be likely to impair perceptibly the progress of the pest on vines already infested.]

In a previous report (1882) an account was given of some experiments in growing wild grape vines from seed, as also of the influence of carbon bisulphide upon the cuttings disinfected by means of its vapor. It was deemed desirable to institute comparative experiments on the facility with which the native Californian and Arizonian vines can be grown from cuttings. For the sake of farther comparison, cuttings of the summer grape (*Vitis aestivalis*) and of the northern and southern Riverside grapes (*Vitis riparia* and *cordifolia* respectively) were also planted under precisely similar circumstances. All the cuttings were taken from vines growing in the garden of economic plants, and without exception wholly of the previous season's wood, which was very thin, being on the average not more than one-sixth inch in diameter.

The cuttings were all made about the same time, viz. at the end of December, 1883; and were cut 8 to 9 inches long. Soon after they were put underground in a shady place, and there remained until planting time.

The soil of the nursery bed being a rather heavy loam, its condition was improved by a heavy dressing of barnyard manure, and with the subsequent addition of 50 pounds of quicklime to an area of 20x30 feet, or about 1-72d part of an acre.

At the beginning of April the bed was deeply dug with forks, and on April 6th the cuttings were planted, some sand being spread in the bottom of the trench to facilitate rooting. Drills were placed 18 inches apart, and cuttings 4 to 6 inches in the row, two eyes being left above ground, the lower one just at the surface.

The *Vitis riparia* was the first to start, and was followed in eight or ten days by the *Arizonica*; the *Californica* being the last, fully three weeks after the *riparia*, and starting quite slowly. The *aestivalis* started a trifle sooner than the last mentioned.

During the season (which, as will be remembered, was quite a moist one) the bed did not receive any watering, but was kept clean and well worked.

Small as these cuttings were, their growth has been very good, and as shown in the table below, a large percentage of all the varieties rooted; each kind exhibiting its peculiar habit of growth.

The *riparia*, which started first, was also the first to stop, the leaves all turning yellow at the end of September. The *Arizonica*, at the same time, showed signs of having made all its growth but kept a good green color; while the *Californica* still continued to grow vigorously. The same order, precisely, was observed in the 4 year-old vines from which the cuttings had been taken, so that it doubtless represents fairly the respective habits in this climate.

The bed at the time presented an interesting sight; the *riparia* with its long spreading canes and fading color contrasting strikingly with the bushlike, upright habit of the Arizonian vine, and both with the running but more robust habit of the Californian. The leaves of the latter only yielded to frost and remained on the canes until spring. The *Arizonica* dropped them soon after the first frost.

The following table shows at a glance the main points in the growth of the several species.

NAME.	Per cent of cuttings growing	Average length of canes—feet	Diameter at root crown—inch
<i>Vitis riparia</i>	95	3.1-2	3-8ths.
<i>Vitis Arizonica</i>	97	2.0	5-16ths.
<i>Vitis Californica</i>	85	3.0	7-16ths.
<i>Vitis aestivalis</i>	85	2.0	3 to 4-16ths

The roots of the cuttings exhibit the same striking differences observed in the seedlings

of the same species. The Californian vine has by far the most vigorous roots, as well as the smallest number, and these strike directly downwards. The roots of the *Arizona* are next in vigor, and also strike straight downwards, but are much tougher in texture. The *riparia* has a great profusion of roots, but of a

much more spreading habit, apparently seeking to remain near the surface; a habit it always retains when older, and to which its early starting may in part be due. The *estivalis*, although apparently the smallest and weakest grower, yet develops a powerful root system with a more downward tendency than the *riparia*, and in deep soils, or where roots can penetrate deeply into the substratum, it should do well. Its roots are during the first few years stronger in proportion to the top than is the case with any of the other species tested, and this speaks strongly in its favor for use as a grafting stock.

As it is in many cases of importance to be able to distinguish the canes of the several wild species from each other, I call attention to the distinctive characters afforded by the configuration of the pith at the nodes or eyes, when a joint is cut lengthwise; a subject to which attention was first called by the late Dr. Engelmann, and of which examples referring to Eastern species are figured in the Bushberg catalogue for 1884. In these figures the pith of the *riparia* shows at the node a thin cross partition; in the *cordifolia* or southern Riverside grape, this partition is quite thick. In the southern Muscadine or Scuppernong grape (*V. vulpina*), the partition is entirely absent; while present, in varied forms, in all the other American species. The difference between the *V. Californica* and *Arizona* in respect to the partition is almost precisely the same as that between the *cordifolia* and *riparia*, and will serve to distinguish the cuttings from each other, the cross partition in the *Arizona* being quite thin. Figures are, of course, needed to illustrate these points more exactly, but when once noted they are easily recognized.—W. G. KLEE.

The above record of observations made by Mr. Klee are confirmed by the experience of others, had during the past season. As regards, first, the rooting of *Californica* cuttings, the same percentage result as to success is reported by Messrs. Coates & Tool of Napa, who state that while they have had little success with cuttings from wild vines, they are well satisfied with the outcome from cuttings made from cultivated *Californica* stocks. Mr. J. H. Wheeler reports similar success. The same seems to be true of the *Arizona*, which was at first reported to root with great difficulty. It is true that the season of 1884 was an unusually favorable one for the rooting of cuttings; but in nursery the same conditions can be artificially kept up at any time.

As concerns the use of the several species for grafting stocks, it appears that, as was shown by experiments made on the University grounds in 1881 and 1882 in respect to seedlings, the native Californian stock acquires quickest of all the

thickness of stem or root-crown necessary for grafting. One-year-old seedlings were very successfully grafted on that occasion; and although this might not be practicable in the open ground, the advantage afforded by the *Californica* in this respect is well worthy of consideration. The Eastern *riparia* comes next in the rapid development of stem; and I must testify from personal experience during the past season, to the extraordinary growth made on good soil by *riparia* cuttings planted even after they had sprouted an inch in length. It is, in this respect, quite unlike the slow-growing *estivalis* stock; but it still remains to be determined whether in this case the race shall, in the end, be to the swift. The superficial habit of a large portion of the *riparia* roots leads to the presumption that during summer that portion will often be thrown out of action, if not actually killed, by severe drought and heat, at least in some soils. It is fairly presumable that this cannot remain without influence on the vine's vigor of growth during the time when it is most needed, viz., when the grape is forming. Yet it is at least possible that the extraordinary vigor shown by the *riparia* on rich soils will offset the presumptive disadvantage. Since the species is originally at home in rich lowlands, it is presumable that its best use as a stock will be in corresponding soils here also. The *estivalis* (and *Lenoir*) stock, on the contrary, is quite at home in the uplands and is quite resistant of drought, as well as content with inferior soils.

A most important point to be considered is the relative earliness of the several resistant stocks. However little the stock may specifically influence the character of the fruit, it cannot be doubted that one and the same grape variety grafted on the *riparia* on the one hand and on the *Californica* on the other, would be materially influenced in the earliness of its start in spring, as well as in the maturity of its fruit, by the roots upon which they are severally dependent for the rise of the sap. The *rupestris* is even a more extreme case than the *riparia*, for this spring it has started on an average at least one week in advance of the *riparia* on the same soil; making possible, according to Mr. Klee's estimate, a difference of nearly four weeks as between *Californica* and *rupestris*. In my vineyard at Mission San Jose, the actual difference this season has been about three weeks.

This consideration becomes very serious in relation to damage from frost, which would be much greater on *riparia* roots than on those of the *Californica*. Again, as regards the ripening of grape varieties which it would be desirable to blend, and which yet ripen too far apart in time to be fermented together, it might be practicable to retard the one and advance the other by judicious selection of the stock, so that both should ripen nearly, or quite at the same time. In this respect, as well as with reference to the proper adaptation of stocks to soils in our climate, a multitude of questions remains to be determined—questions, too, of such obvious and vital importance that systematic work in that direction cannot be too speedily begun.

E. W. HILGARD.

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